Training in Neurology: Adoption of resident teleneurology training in the wake of COVID-19

Telemedicine crash course

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Abstract

The coronavirus disease 2019 pandemic has changed the way we engage patient care, with a move toward telemedicine-based health care encounters. Teleneurology is now being rapidly embraced by neurologists in clinics and hospitals nationwide but for many, this paradigm of care is unfamiliar. Exposure to telemedicine in neurology training programs is scarce despite previous calls to expand teleneurology education. Programs that provide a teleneurology curriculum have demonstrated increased proficiency, accuracy, and post-training utilization among their trainees. With the current changes in health care, broad incorporation of teleneurology education in resident and fellow training after this pandemic dissipates will only serve to improve trainee preparedness for independent practice.

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Introduction

The coronavirus disease 2019 (COVID-19) pandemic is forcing a reckoning of current health care delivery and expediting a rapid transition to telemedicine-based care. In 2017, the Telemedicine Work Group of the American Academy of Neurology (AAN) recommended a teleneurology curriculum as an elective rotation for trainees.[1] How long ago 2017 seems now as we all hastily work to create operational teleneurology infrastructure in our clinics and hospitals. Although prior exposure in teleneurology is advantageous in tackling the complexities of moving to telehealth-based care, most of the neurology workforce is not formally trained in telemedicine. While we are far from fully understanding the long-term sequelae of this pandemic on our health care systems, broader exposure and increased comfort with teleneurology is imperative to prepare our trainees for the new world of medicine they will face after the current pandemic dissipates.

Contemporary teleneurology practice

Neurology has long recognized the power of telemedicine in addressing gaps in access to care. Telestroke became an established practice among stroke centers in the mid-2000s, prompted by the STRokE DOC[2] trial demonstrating diagnostic accuracy in acute stroke care. In the outpatient setting, teleneurology is an alternative for some patients with chronic conditions and disability that make an in-person trip to a subspecialty clinic difficult. Teleneurology support for outpatient neurology care is well-described in the recent update by the Telemedicine Work Group,[3] whose comprehensive review outlines the importance of teleneurology in improving patient satisfaction, patient-associated costs, and caregiver burden, without sacrificing quality of care.

However, teleneurology is far from universally embraced. Limitations in the neurologic examination over camera, dissatisfaction with potential technical failures, and a sense of

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depersonalization from a lack of physical interaction with patients contribute to slow acceptance of this care modality. Perhaps the greatest barrier to broader adoption of practice was the lack of infrastructure for reimbursement prior to our current public health crisis. Because the Centers for Medicare and Medicaid Services (CMS) relaxed billing regulations and privacy guidelines temporarily to allow providers to continue caring for their patients remotely,[4] neurologists have the ability to prove the utility and importance of teleneurology. While current CMS reimbursement for teleneurology is intended for use only during the pandemic, routine teleneurology care—once shown feasible and effective—will become a standard tool for facilitating physician–patient interactions.

Are we preparing our trainees for this new world of health care? Regardless of reimbursement, the need for teleneurology is not going away after this crisis passes. Telestroke is already ubiquitous among vascular neurology divisions. Many academic departments are establishing tele-neurohospitalist capabilities for community hospitals. Five telehealth companies already provide nationwide teleneurology services. Setting up a teleneurology curriculum for trainees requires investment in time, effort, and finances from faculty and departments; however, decreased overhead costs, improved patient satisfaction, and decreased patient attrition could potentially offset that cost.

Existing models of teleneurology training

Dedicated teleneurology training is rare in neurology residencies. A literature search identified 1 fellowship and 2 resident training programs that describe formalized education in teleneurology. The University of California San Francisco implemented a teleneurology rotation for their postgraduate year 3 and 4 residents.[5] After 2 nonconsecutive 2-week blocks of didactics and rotating in telemedicine-based neurology outpatient clinics, residents had improved telemedicine knowledge, more favorable impression regarding teleneurology, and fewer perceived challenges in conducting the neurologic examination over a camera. The Mayo Clinic at Jacksonville, Florida, instituted a telestroke education program for their residents with didactics, simulation training, and real-time clinical practice. Residents now train to conduct prehospital assessments of potential stroke patients via telemedicine-enabled ambulances prior to arrival to their comprehensive stroke center,[6] and their study on the effects of this training on door-to-needle times is ongoing.

Vascular neurology training programs incorporating telestroke education illustrate the real-world effects of formalized telemedicine training. The University of Texas Health Science Center in Houston (UTHSC), Cedars-Sinai Medical Center, and University of Utah Medical Center provide dedicated telestroke education in their respective stroke fellowships and track door-to-needle times for fellows and faculty as a training metric. A survey of graduates from UTHSC reported exposure to telemedicine as fellows led to proficiency in telestroke care, and almost a third of graduates from that program went on to start telemedicine networks in their respective practices. Review of thrombolytic metrics at the UTHSC telestroke network revealed that fellows took 9 minutes longer to administer alteplase from page time compared to attendings. This lag gradually decreased with increasing fellow experience and proficiency in performing teleconsultations, improving page-to-needle time by 1 minute for every 14 consults.[7] Data from the University of Utah linked training and experience with more appropriate deployment of teleconsultations and avoidance of unnecessary utilization.[8] Familiarity and repetition can clearly improve teleneurology competency and efficiency.

The AAN recognized the need to incorporate telemedicine in neurology training in 2013 and multiple subsequent publications outline recommended curricula,[1,5,6,9] provide data on implemented programs,[7,9,10] and demonstrate the real-world benefits of systematic telemedicine training.[7–9] Anecdotally, the residents at our 3 institutions have expressed increasing interest and curiosity regarding additional teleneurology exposure, which is magnified by the emergent changes in clinical practice implemented in response to the COVID-19 pandemic. The lack of mandated education in this area has led to slow adoption of training in teleneurology. Vascular neurology fellowships are increasingly incorporating telestroke training, but even in centers with robust telestroke networks and training programs, resident exposure prepandemic was scarce.

Towards broad adoption of teleneurology education

Trainees would most effectively benefit from a teleneurology rotation, or other clinical exposure to teleneurology, midtraining, after mastering the in-person neurology encounter. The AAN Telemedicine Work Group recommends comprehensive training in clinical bedside neurology for the safe practice of teleneurology.[3] Accreditation Council for Graduate Medical Education (ACGME) neurology milestones or the Neurology Clinical Evaluation Exercise can guide evaluation for teleneurology competency. Adapted from our institutions' programs, the table offers an example of potential competencies and milestones for a teleneurology curriculum. Training can help hone skills such as "webside" manner; communication with telepresenters, both novice and experienced; interpretation of remote neurologic examinations; accuracy of diagnosis and treatment plans; efficient consultations/evaluations; and recognition of the limitations of teleneurology. Multiuser teleneurology software can provide trainees direct supervision by an attending physician, albeit

Table Example of existing teleneurology competencies and suggested rotation milestones

Setting	• Background: minimal complexity and movement to preserve video quality; avoid fans; prefer a plain wall and a smaller room • Lighting: bright light in front of neurologist's face; avoid backlighting • Sound: headset ideal to prevent feedback; if you get feedback, turn down the speaker volume; avoid moving the microphone farther away, which will worsen feedback • Ask the patient to minimize number of people to 1–2, and to minimize movement; ideally, rest device on firm surface rather than hand-held • Recommend a quiet well-lit room away from pets, children, nonessential staff; encourage participants to speak one at a time • Ask scheduler to coordinate availability with home health if possible
Telepresence	• Note delta angle between camera and patient image on screen; to maintain eye contact, practice looking counterintuitively at camera, not the screen, when speaking to the patient • When multitasking, documenting in the electronic record, or reviewing films and laboratory studies, be explicit what you are doing so it does not seem that you are not paying attention • Start encounter by obtaining all participant names; use names (instead of body language) to direct questions and get attention • Ask those speaking to come into view of the camera, both to get your attention and optimize use of directional microphones • At visit conclusion, explicitly address the future nature of your relationship including follow-up and modality
Teleneurologic examination	• Conduct the neurologic examination in order to minimize need to reposition cameras • Use examination demonstration and mimicking, particularly in the absence of an assistant • Mental status: mostly observational; mini-cognitive examination possible; with a trained assistant, more complex cognitive tests are possible • Cranial nerves: zoom in for eye movements, face, tongue; may rely largely on voluntary saccades to each direction; zoom out for everything else; visual fields can be checked with patient's hands extended in front of the field of view or more formally if an assistant is present • Zoom out slightly: pronator drift, satellite sign, digiti minimi sign, finger escape sign; more formal strength testing is possible with an assistant; test coordination with nose-full extension-nose, or finger-nose-finger if assistant present • Zoom out more: leg drift, heel-knee-shin, sensation of face/arms/legs, gait • May be able to test more detailed strength, tone, reflexes, sensation if assistant present
Milestones	
Level 1	• Performs a complete, organized, and relevant history in nonemergent setting • Demonstrates ability to adapt basic neurologic examination to telemedicine platform • Formulates an assessment and differential diagnosis • Able to provide initial treatment recommendations for inpatient and outpatient conditions
Level 2	• Able to establish rapport with patient and family and address all members in the room • Performs an efficient, complete, and relevant history and comprehensive examination, including formal motor, sensory (3 modalities), cranial nerve, coordination, gait examination • Localizes the lesion based on the teleneurologic examination • Formulates an accurate assessment and differential diagnosis as assessed by a supervision attending • Identifies patients in need of in-person neurologic evaluation and management; identifies patients at high risk of neurologic deterioration • Identifies and addresses technical issues, and calls for assistance appropriately
Level 3	• Able to evaluate urgent neurology consultation in emergency department setting efficiently via robot and without unnecessary delay • Able to conduct examination on comatose patient • May be able to test reflexes, tone, proprioception with assistance • Identifies and facilitates transfer independently, communicates efficiently with spoke hospital physicians and staff
Level 4	• Efficient communication with family and patient regarding patient condition and plans in acute neurologic conditions • Ability to conduct efficient history and physical examination for emergent consultations remotely with the assistance as needed from spoke staff and under direct monitoring of supervising hub physician • Demonstrates fluency with Emergency Medical Treatment & Labor Act rules; displays high level of professionalism in all communications • In nonemergent conditions outpatient or inpatient, able to adapt specialized examination tools for appropriate patients: Unified Parkinson Disease Rating Scale for Parkinson Disease, American Spinal Injury Association spinal cord injury scale, Montreal Cognitive Assessment Test
Level 5	• Serves as a role model for other trainees in performing telemedicine consultation including efficiently obtaining relevant history and examination, treating acute ischemic stroke and acute risk factors, postthrombolytic triaging for surgical/endovascular procedures • Efficiently coordinates transfers to higher level of care as necessary • Able to conduct goals of care conversations as appropriate with family

sometimes at increased cost. Bringing residents and fellows to community hospitals for site visits, especially when activating a new site, can teach how to be a valued partner with local nurses and physicians and help better understand the patient experience. Faculty with experience in teleneurology and curated from a broad spectrum of subspecialties should assist in teaching skills. Inherent differences in conducting visits with patients with movement disorders vs dementia vs stroke should be highlighted during training. Posttraining and lifelong learning of teleneurology can take the form of board examination questions and Maintenance of Certification Program activities.

Embedding trainees in telemedicine consultations provided by senior neurology staff may not be straightforward. Each institution must tackle local barriers in licensing and credentialing. For programs servicing sites in multiple states, the new

interstate licensure compact does not circumvent difficulties in licensing for fellows. Community hospitals do not lend themselves naturally to a teaching environment and many sites may hesitate to allow trainees on camera. Contractual educational agreements may alleviate some of this concern by assuring appropriate supervision and expectations. With these concerns in mind, teleneurology training should always begin with trainee observation of seasoned teleneurologists before graduating to more trainee-driven consultations. Initial encounters may be more manageable in less urgent, outpatient settings as residents and fellows gain familiarity with teleneurology skills. Standardized patients and simulation-based training may also provide some of the requisite experiences if live patient encounters are not feasible. The University of Utah uses SimLearn curricula to design telestroke simulations for new providers and have started to extend this to residents.

The COVID-19 pandemic necessitates novel and flexible vehicles for emergency and longitudinal care and provides a unique opportunity to expand education and adoption of telemedicine as a routine form of health care delivery. The ACGME should request telemedicine curricula in accredited neurology residencies and fellowships to reflect this real-world transition towards remote teleneurology consultations. Omitting teleneurology didactics leaves our trainees unprepared for the realities of modern-day neurology independent practice. It is time for us to shed our teleneurophobia and implement the changes necessary for programs to adequately prepare our future neurologists.

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References

1. Govindarajan R, Anderson ER, Hesselbrock RR, et al. Developing an outline for teleneurology curriculum: AAN Telemedicine Work Group recommendations. Neurology 2017;89:951–959.
2. Meyer BC, Raman R, Hemmen T, et al. Efficacy of site-independent telemedicine in the STRokE DOC trial: a randomised, blinded, prospective study. Lancet Neurol 2008;7:787–795.
3. Hatcher-Martin JM, Adams JL, Anderson ER, et al. Telemedicine in neurology: Telemedicine Work Group of the American Academy of Neurology update. Neurology 2020;94:30–38.
4. Coronavirus Preparedness and Response Supplemental Appropriations Act, H.R. 6074, 116th Congress (2020).
5. Afshari M, Witek NP, Galifianakis NB. Education research: an experiential outpatient teleneurology curriculum for residents. Neurology 2019;93:170–175.
6. Tipton PW, D'Souza CE, Greenway MRF, et al. Incorporation of telestroke into neurology residency training: "time is brain and education". Telemed J E Health Epub 2019 Dec 10.
7. Jagolino-Cole AL, Bozorgui S, Ankrom CM, et al. Benchmarking telestroke proficiency: page-to-needle time among neurovascular fellows and attendings. Stroke 2017;48:2618–2620.
8. de Havenon A, Chung LS, Smith J, Taylor K, Majersik JJ, Chauhan N. Less experienced telestroke consultants are more likely to go on-camera, but less likely to give tPA. Stroke Res Treat 2019;2019:1059369.
9. Jagolino AL, Jia J, Gildersleeve K, et al. A call for formal telemedicine training during stroke fellowship. Neurology 2016;86:1827–1833.
10. Kramer NM, Demaerschalk BM. A novel application of teleneurology: robotic telepresence in supervision of neurology trainees. Telemed J E Health 2014;20:1087–1092.